PowerBox Systems

World Leaders in RC
Power Supply Systems

PowerBox Battery

Operating Instructions

With integrated charge- and safety circuits
With integrated Lipo Balancer
With integrated low voltage monitor
With integrated low voltage warning per LED

Dear Customer,

We are delighted that you have decided to purchase a modern **PowerBox Battery** from our range.

This is a new, pioneering battery design for use in RC models, in which **safety** and **user-friendliness** take absolute priority. It is a power supply system which we have developed specifically for use with the receivers and servos in our models.

The high-quality Lithium-Polymer cells used in these battery packs are manufactured especially for us and for this application. Their outstanding features are very high energy density, long effective life, good resistance to vibration and ultra-low internal resistance by the standards of LiPo cells.

We hope you have many years of pleasure and successful flying with your **PowerBox *Battery***!

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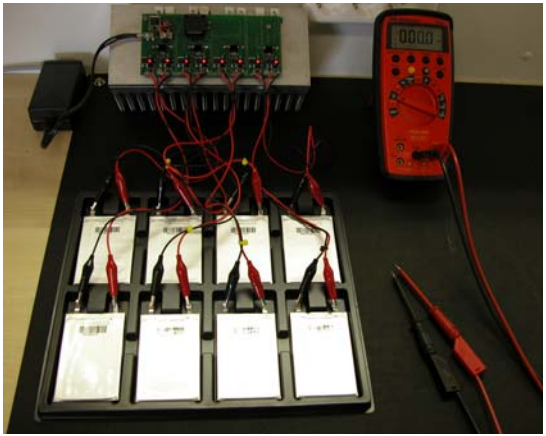
1. Productdescription

Right at the design stage every **PowerBox battery** is developed using the best materials and the latest LiPo cells available today. This philosophy enables us to improve our products constantly by introducing new developments from other manufacturers. For example, the new charge IC made by chip manufacturer Texas Instruments was built into our products immediately it became available. The charge system of the original battery was limited to max. 10.5 Volts, but only one year after the battery's introduction the new chip allowed us to increase the voltage spectrum for the charge system to 17.0 Volts. This was particularly welcome because the new IC immediately made it possible to charge the battery from any 12 Volt car accessory socket.

As with our other PowerBox products, these battery packs are assembled using what are known as gold circuit boards (the surface of the conductor tracks is gold-plated; this allows components to be positioned more accurately, and provides improved conductivity and resistance to oxidation.

The LiPo cells we use are manufactured specifically for our battery packs, i.e. they are made to meet our precise specification, for the purpose defined by us, and are not just mass-produced cells which were not originally intended for use in RC models. Before any further work is carried out on them, these cells are subjected to a sophisticated selection process here at PowerBox Systems, matched to a tolerance of 1/1000 Volt, and then assembled to form two-cell packs.



The cells are attached to the circuit board using a special soldering process developed by us in-house.

We then give the packs a complete discharge and charge cycle, enabling us to determine whether the electronic charge and safety circuits are working correctly, and what you can expect from the packs in terms of performance for your RC system. Each stage of production is followed by a specific testing procedure. In fact, the tests alone are responsible for more than **70%** of the production time required for a **PowerBox Battery**.

It is our hope and expectation that you will benefit from this!

2. More on the construction of PowerBox Batteries

The entire charge process is controlled by a sophisticated electronic safety circuit which constantly monitors voltage and time. It is managed by a specially developed IC in conjunction with an SMT temperature sensor which is embedded in the circuit board, between the two Lithium-Polymer cells. This is another PowerBox innovation.

To charge this battery pack safely and reliably all you need is a mains PSU or our 12 V car adaptor. This arrangement results in a charge process which is perfectly matched to the LiPo battery itself. The procedure is simple and safe, as for all modern electronic devices which nowadays accompany us in our daily life, such as mobile phones, laptops, digital cameras and others, and which we now operate almost without thinking.

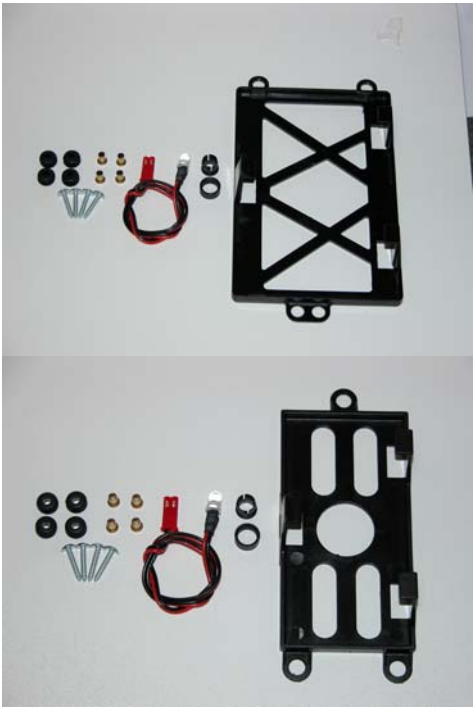
A robust protective case reliably shields your valuable Lithium-Polymer battery and the electronics from all external influences, and in particular from mechanical stresses in the model.
The security of this battery system is further enhanced by the dedicated mount, which has been specially developed for our battery pack.

This battery mount is supplied **free** with every PowerBox **Battery 1500 and 2800!**

The battery mount provides an excellent method of installing your battery pack in any model, as it provides absolute security and good protection from vibration. The three / four mounting points are arranged in a special triangular format with sides of unequal length. The unique, carefully calculated geometry of the mounting points ensures that the battery mount can be screwed securely and safely to any surface without any risk of distortion, even if the sub-surface is completely irregular or curved, and still provides full vibration-damping.
The PowerBox Battery locks into its dedicated mount, where it is held securely and without distortion.

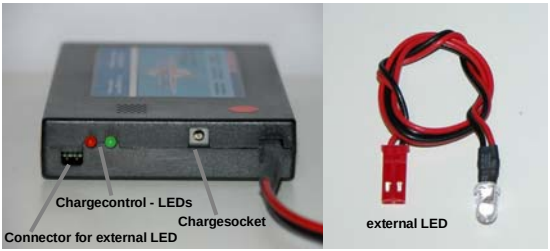
Don't trust simple cable-ties, fuel tubing or serendipity for mounting the PowerBox Battery in a model!

The battery mount is also available separately for use in other models.



Extension charge leads are available for both batteries. These cables enable you to install your PowerBox battery in the most advantageous position in the model from the point of view of space and Centre of Gravity. The charge socket can then be mounted in the cockpit or in the fuselage side, providing easy access for charging the batteries.

As you will have noticed, every PowerBox battery is supplied with an external LED with matching LED mount. The LED is simply plugged into the slightly projecting pins adjacent to the two LEDs. The polarity of the connection must be correct; you can easily check this as the connector opening has chamfered corners.



The low voltage monitor is completely autonomous, i.e. it does not require any auxiliary device, and it provides useful protection for your LiPo battery from under-voltage, which is dangerous for LiPo batteries.

After a lengthy period of storage, or after a protracted day at the flying field, there is always a danger that a LiPo battery's voltage will fall below 2.5 Volts per cell. This is a crucial figure, as it means life or death to the cell. Below this voltage the chemical medium within the cell changes permanently, with the result that a gradual gasification process starts during the subsequent charge process. The gas generated causes the cell to inflate slightly. In this condition it will no longer be able to provide its full performance, and after a few more charges it will need to be replaced.

The pressure inside the cells can be enormous, causing the protective case to distort, and even to burst in extreme cases.
This low voltage is critical for any LiPo battery, and that is why we have fitted our batteries with an LED low voltage alert.

The LED starts to glow **at a battery voltage of about 3.5 V** (single cell voltage); this indicates that the battery is gradually becoming discharged.
You can check this while the model is flying if you install the LED in a visible position on the model e.g. in one fuselage side. You will then be able to see when it is time to land.

However, you can also use the LED to monitor the battery over the Winter storage period. If, for whatever reason, the battery falls to the appropriate voltage threshold (7.0 V), the LED will automatically start to glow.

From this point on you have two or three weeks in which to notice the LED in your battery storage room; when you see the glowing LED, you should recharge the battery as soon as possible.

If the battery voltage falls to about 3.0 V, the low voltage detection is switched off again. At this point the safety margin for the survival of the battery is only about 0.5 Volts; if the LED goes out, it is really urgent that you recharge the pack.

Two years ago we started fitting this low voltage alert to our batteries, and since that time the number of packs which have failed after the long Winter break has been reduced by 90% - proof enough of the importance of this feature.

3. Specification

PowerBox Battery 1500

Capacity:	1500 mAh / 7.40 Volt
Final charge voltage:	8.40 Volt
End of discharge:	at 5.80 Volt - no load
End of discharge:	at 6.20 Volt - under load of receiver and servos
Charge voltage for internal charger:	10.5 - 17.0 Volt +/- 0.1 Volt
Temperature range during discharge:	0° C to + 40° C
Temperature range on charge:	0° C to + 40° C
Weight incl. cables and connectors:	91 grammes (JR / Futaba) 99 grammes (MPX high-current)
Dimensions:	88 x 46 x 17 mm (L x W x H)
Length of connecting lead:	270 mm
Weight of battery mount:	15 grammes

PowerBox Battery 2800

Capacity:	2800 mAh / 7.40 Volt
Final charge voltage:	8.40 Volt
Discharge cut-off:	at 5.80 Volt - no load
Discharge cut-off:	at 6.20 Volt - under load of receiver and servos
Charge voltage for internal charger:	10.5 - 17.0 Volt +/- 0.1 Volt
Temperature range during discharge:	0° C to + 40° C
Temperature range on charge:	0° C to + 40° C
Weight incl. cables and connectors:	152 grammes (JR / Futaba) 156 grammes (MPX high-current)
Dimensions:	106 x 65 x 16 mm (L x W x H)
Length of connecting lead:	270 mm
Weight of battery mount:	17 grammes

4. Charge Process

Switch off all electrical devices before charging!

The battery packs can remain connected to other PowerBox equipment during the charge process.

To ensure long battery life and a safe, controlled charge process, we recommend that you use our dedicated charging systems, which have been developed specifically for the purpose. Both charge units (mains PSU and car adaptor) have two contacts for simultaneous charging of two battery packs.

The integral electronic safety circuit which we build into every battery pack includes a temperature sensor and voltage / time control system. However, this circuit is only active if you charge the pack using the mains PSU (with 110 - 220 Volt input voltage, for use world-wide), or the 12 Volt car adaptor.

The pack's internal LiPo balancers are also active if you wish or are obliged to charge it using a LiPo-capable battery charger and the external charge lead.

Many modellers may want to check the charged-in capacity or the consumption in mAh from time to time. This can be carried out by charging or discharging the pack via the battery connecting lead, using a LiPo-capable battery charger, but we do not recommend that you do this regularly. As mentioned above, no integral electronic safety circuits of any kind are active when you charge the pack through the battery connecting lead, and it is then up to your battery charger to provide the safety measures. By the same token you by-pass the controlling mechanisms integrated into the charger, so we can no longer guarantee correct charging of the pack.

Charging the **PowerBox Battery** is as simple as charging a mobile phone, a laptop or any other modern electronic device which we now take for granted. Incidentally, LiPo batteries were originally developed by large-scale industry with just this kind of simple charging method in mind, and the electronic components required for this are readily available. To our minds it is therefore utterly incomprehensible why the modelling industry has made the charging of LiPos so complicated. The modeller finds this new, modern battery technology much more difficult to exploit than is necessary, due to the apparent need to use an expensive, complex battery charger and a separate balancer, with all manner of connectors. It is hardly conducive to trust in technology when we read peculiar charging instructions such as 'charge only in a flower pot'. Would you buy a mobile phone for your children, or even for yourself, if the manufacturer advised you to charge it in a flower pot? Surely not; you'd always opt for the products of another, more reliable supplier, wouldn't you?

When you connect the charge plug to the socket of the **PowerBox Battery**, the red LED lights up to indicate that the charge process has commenced correctly.
The green LED lights up when the charge process is concluded just as correctly. That's it.

If a problem occurs, the red LED starts flashing, or goes out. If this should happen, it is best to terminate the charge process for reasons of safety.
Please attempt to restart the charge process by connecting the charge plug again, perhaps leaving it a little while.

If the electronic charge circuit does not allow the battery to be charged even after several attempts, we recommend that you send the pack back to us for checking, together with the mains PSU or the car adaptor you are using.

5. Safety notes, hazards and warning:

Hazard information:

- Do not connect the positive terminal to the negative terminal (short-circuit)
- Do not incinerate or dispose of the battery in an open fire
- Do keep the battery well away from any heat source (engine, silencer)
- Do not allow the battery to contact water or model fuel
- Do charge the battery only under suitable conditions (not above 40°C if possible)
- Do not use a battery which is obviously damaged or distorted
- Do not the use the battery for any other purpose than the intended application
- If the battery should leak, do not allow the electrolyte to touch your skin

Warning Notes:

- Never connect the battery pack directly to a receiver or servos, as the voltage of up to 8.40 Volts could destroy these components.
- The basic rule is that the battery pack should only be connected to PowerBox system components approved by us, such as the PowerBox 'Digi-Switch', 'Sensor', 'Evolution', 'Competition', 'Champion' or the Volt Regulator.
- When charging is complete, terminate the process by disconnecting the charge lead.
- Do not place the battery in a microwave oven or any pressurised container.
- If the battery should leak, or produce an unusual smell, keep it well away from any open flame (the electrolyte is inflammable).
- Batteries may only be connected directly to a 12 Volt car battery via the charge socket if they are approved by us for this type of charge process (manufactured in 2006 or later).

- Do not use the battery in conjunction with any other make or type of battery (NiMH, NC, Li-Ion).
- The battery can be charged using an external charger connected to the battery cable, but we wish to point out expressly that such methods disable all the electronic safety measures which we have provided to ensure a safe charge!

Safety Notes:

- Do not subject the battery to high temperatures, as this runs the risk of compromising the guaranteed performance and life expectancy of the battery.
- The battery contains integral safety elements. Do not use the battery in a location which is subject to powerful static electrical charges.
- The guaranteed temperature range on charge is between 0°C and 40°C.
- The integral battery guard circuit controls over-voltage and under-voltage, temperature, maximum charge time and maximum current, but only if the pack is charged via the standard charge socket.
- Store the battery out of the reach of children.
- When the battery reaches the end of its useful life, insulate the working contacts to guard against short-circuit.
- Stop using the battery if it emits an unusual smell, feels hot to the touch or has changed shape.

Don't open the battery pack! Opening the case will wreck it, and this in turn presents the risk that the Lithium-Polymer battery inside it will be damaged.

6. Guarantee Conditions:

Every **PowerBox Battery** is subjected to a series of checks during the production process. This begins with selecting the electronic components and the individual cells, and continues right up to checking that the charge and discharge characteristics are as specified.

At PowerBox Systems we place special emphasis on the highest standards of quality.

We therefore guarantee this product for a period of **12 months** from date of purchase. If there is a proven material defect, we undertake to correct it at no charge. If repair of the battery pack is not possible for economic reasons, we reserve the right to replace it.

Any repairs which we carry out for you in our Service Department do not extend the original guarantee period.

Incorrect usage, such as **reversed polarity**, excessive vibration, excess voltage, damp, fuel and short-circuits invalidates any claim under guarantee. The same applies if a defect has been caused by severe wear.

We will not consider any claims under guarantee beyond the limits described above, e.g. consequent damage.

We deny liability for damage caused by the device or the use of the device.
We accept no liability for transport damage or loss of your shipment. If you need to make a claim under guarantee please send the unit to us at the following address, enclosing proof of purchase:

PowerBox-Systems, GmbH
Ludwig-Auer-Str. 5

D-86609 Donauwörth
Germany

Liability exclusion:

We are unable to ensure that the **PowerBox Battery** is installed and operated correctly, nor that the entire radio control system has been maintained properly.

For this reason we are unable to accept liability for loss, damages or costs which result from the use of the **PowerBox Battery**, or are connected with its use in any way. Unless otherwise prescribed by law, our obligation to pay compensation, regardless of the legal argument employed, is limited to the invoice value of that quantity of our products which was immediately and directly involved in the event which caused the damage.

7. Available Accessories

- Charger
- 12 V car adaptor
- Extension charge lead
- Battery mounts

We wish you every success using your new **PowerBox Battery**, and hope you have loads of fun with it.

Donauwörth, October 2006

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